SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

FRIDAY, JULY 29, 1904.

CONTENTS:

MSS. intended for publication and books, etc., intended for review should be sent to the Editor of SCIENCE, Garrison-on-Hudson, N. Y.

*THE MOSELY EDUCATIONAL COMMISSION.**

I.

THE places visited by me as a member of the commission were New York, Baltimore, Washington, Cleveland (Ohio), Buffalo, Ithaca (Cornell University), Boston, Yale and Middletown (Conn.). But on a previous occasion, six years ago, when I was three months in the country, I crossed the American continent twice from east to west, including the journey from Montreal to Vancouver by the Canadian Pacific Railway. I then spent a considerable time in the west and saw much of Chicago, as well as of Minneapolis and the great wheat region in the northwest. As a student, I was brought much into contact with Americans; this has led me always to take a special interest in them, and I have all my life been a close observer of American scientific work. Any opinions that I may have formed are, therefore, something more than mere impressions derived from my recent brief visit.

It is very difficult to evaluate the part which school education plays in the United States of America. That it plays a real part can not be doubted; but there is clearly a tendency somewhat, if not greatly, to exaggerate its relative importance as a factor in the national welfare. In point of fact, American cuteness would seem to be conditioned by environment rather than by school education. The country was settled by adventurous, high-minded men; the adventurous and restless spirits of Europe have been attracted there for generations

* Report of Professor Henry E. Armstrong, Ph.D., LL.D., F.R.S.

past; the conditions have always been such as to develop enterprise and to stimulate individuality and inventiveness: so that, during the whole period in which the continent has been gradually acquired and settled on, there has been a constant invigorating struggle going on against nature in one form or another, the Indian probably having played no mean part in the education of the race. Such being the case, it is important to remember that some at least of these influences are now withdrawn and that development may, in consequence, be along different lines in future, especially as the enervating influence of machinery is also coming into play more and more.

In some respects, the Americans may be said to be a distinct if not an improved breed. Certain proclivities have undoubtedly been unconsciously selected out, and there has been much cross breeding; hence a race has been developed differing in important respects in its type of thought, if in no other way, from those represented in Europe. Moreover, success has given them belief in themselves and leads them to trust themselves. The natural resources at their disposal are boundless and their outlook is extraordinarily hopeful; they are born optimists, in fact. They have also learnt to work together and to accept and support party rule; they seem, indeed, to tolerate direction and to subordinate their individual opinions to an extent which we have difficulty in believing possible—so much so that they may be said to lack individuality. Willingness to organize and to be organized is almost characteristic of the nation. Uninfluenced by tradition, they are eminently receptive—always ready to consider and test new ideas; nevertheless, the conservatism characteristic of a young country is in many ways still manifest among them.

It is difficult to trace the development of any American peculiarities to the schools—or to find any evidence even that the schools seek to utilize and develop the national idiosyncrasies.

After seeing a number of schools in detail—both common schools and public high schools—it seems to me that they are much as our schools; that the problems they are seeking to solve are our problems; that their difficulties are our difficulties. In matters of organization and administration, we apparently can learn many things from them; but, as regards method, it seems to me that we have very little to learn; indeed, in depth of purpose and originality, our best work may not unfairly be said to be considerably in advance of theirs. But whereas here we have no general belief in education, in America the common school system is universally held in high esteem and its influence is very great. The mere fact that all classes are brought together in the common school is in itself of the utmost importance as affecting the social outlook; even those who prefer to send their children to private high schools seem to think it desirable that they should first attend the common school in order that they may consort with others.

The belief in secondary education, especially for boys, is far less general—it is probably no greater than ours—and yet, it seems to me, that it is by the existence of a well-developed public high school system that America is distinguished most from us and potentially placed most in advance of us.

What has until recently counted as university education here is almost unknown in America. What will count as university education here ere long, as the various provincial universities become effective, is already developed in America to a considerable extent and is advancing with giant strides. The support of university education is become a fashionable practise among

multi-millionaires, and the appreciation of such education by employers generally has reached a point as yet undreamt of here and is growing rapidly, owing to the establishment of an effective working connection between the manufacturing industries and the colleges. The belief in higher education may be expected to grow at a compound interest rate. This, it seems to me, is the great fact to be taken note of, if—as we undoubtedly must—we are to regard education as an effective means of promoting national welfare. It will undoubtedly force on the development of the public high schools. But, as I shall have occasion to point out, American education is for the most part still governed by eminently academic and conservative traditions; in some respects it lacks depth and practical outlook to a strange extent.

The movement which has led here, during the past twenty years, to the erection of technical schools all over the country and of the numerous polytechnics in London, is only beginning to come into evidence in America. Evening class instruction, such as has grown up under our science and art department, is almost unknown there.

In New York and other large towns we saw many fine public school buildings. But if buildings are to be regarded as evidence of appreciation, we may point to those erected by school boards all over this country; it is probable that in size, number and appointments they compare not unfavorably with those to be found in America, taking into account the areas dealt with. The building, it must not be forgotten, appeals to the public sense: it can be pointed to with pride. This is distinctly the attitude adopted in America towards the public school buildings. I am not aware that we take particular pride in the erection of our board schools: it is rather our habit to grumble at the outlay they involve.

The Common Schools.—In interior arrangements even the most modern schools are not superior to our own. And there is even less attempt made in them to provide pictorial decoration. Thring's great doctrine of *thinking in shape* has, if possible, made less advance thus far in the American common schools than in ours.

Much has been said of the importance attached in the American schools to the teaching of patriotism and to the practise of saluting the flag which prevails in them. This involves the recitation occasionally of the formula: 'I pledge allegiance to my flag and to the republic for which it stands —one nation, indivisible, with liberty and justice for all.' This appeared to me to be a somewhat perfunctory exercise when I witnessed it. Thinking Americans with whom I discussed the question seemed to regard the practise as of some value in cities like New York and Chicago, where a large alien element has constantly to be absorbed into the population; but apparently they were of opinion that it was undesirable as a general practise.

It is almost unnecessary to say that the amount of attention paid in the common schools to reading and composition is in no way sufficient or satisfactory, the neglect of English among English-speaking people being proverbial. Apparently no greater effort is made in the American schools than in ours to lead children to read and to become really fond of reading.

The teaching of drawing is also undeveloped. Simple measurement work in association with drawing, which is being so much advocated here and which is gradually assuming importance in our schools, seems to be almost, if not quite, unknown. I did not learn that the attempt was being made anywhere to put the teaching of

arithmetic on a practical common-sense basis.

Although manual training figures in the program, the interpretation put upon the term seems to be very different from that which is usual here, drawing commonly counting as manual training. In some of the schools, where space permits, woodwork is introduced into the upper classes for boys, and cookery and needlework for girls. The belief in such work is evidently growing; but at present the schools are undoubtedly behind ours in promoting it and even more bookish than ours in their tendencies.

The nature study lessons I witnessed, when not specifically botanical or zoological and scientific in character, were eminently superficial and worthless.

As all classes attend the common schools, these can not be compared directly with our elementary schools, but must be thought of in connection both with these and with all other types of preparatory schools.

There are two striking features in them —the air of refinement due to the attention paid to dress, especially by the girls, the preponderating element in most classes; and the attitude of familiarity assumed by the class towards the teacher. Distinctions such as poverty or occupation might well condition even in a democracy are scarcely perceptible. In America the teacher does not seem to be regarded as the natural enemy of the boy—as a person to be circumvented. The method of teaching which appears to be generally adopted involves, as it were, the constant exchange of opinion between teacher and pupil—not, as is here the case, either the communication of information to the class by the teacher or the mere wringing of what is supposed to have been learnt from the pupil by the teacher. The method has both its advantages and its disadvantages. It develops that readiness of address which characterizes young Americans and leads children to give their opinions freely—far too freely many think—on all sorts of subjects; and it encourages cuteness. But it imposes a very heavy burden on the teacher and operates against close study and concentration of attention. In American schools there is no enforcement of discipline by means either of penalties or of prizes. Children are put on a footing with grown-up people and treated as young republicans.

How, then, is discipline maintained? Is it always? Perhaps the average American boy has not such a fund of animal spirits as the English boy—he is sprung from a tolerant race and from an early age tends to ape the behavior of his elders more than the English boy does. Certainly one great cause of good behavior is the presence of girls along with the boys. On the occasion of my former visit, I discussed with one of the chief inspectors in Washington the reasons why the system of mixed classes had been abandoned there and then resumed. I learnt that one of the possible reasons was that it had been found difficult to keep the boys in order when alone. But undoubtedly the chief hold teachers have on their classes is consequent on their maintaining the interest of the pupils. Many of my colleagues on the commission—not teachers—in fact, expressed the opinion on more than one occasion that the teaching was most interesting. But looking below the surface, I did not feel satisfied with all that I witnessed. Whilst every teacher will admit that it is necessary to create interest, we all know that it is not always possible to maintain this at bursting point and that in school, as in the world, uninteresting work must be done sometimes; that, in point of fact, it is most important to acquire the art of doing uninteresting work in a serious and determined way. The American system seems to me to be one which imposes a fearful strain upon the

teachers—especially as they are mostly women. And it has some serious consequences. One of these is inability to concentrate the attention. Everywhere the heads of the high schools complained that the pupils who came from the elementary schools could not concentrate their attention upon their work. Several were of opinion that under the somewhat more rigid conditions of the high school improvement in this respect gradually took place as the pupils moved up. On the other hand, in more than one case it was admitted candidly by the head teacher of the elementary school that the extent to which the children could concentrate their attention diminished as they grew older and passed up the school; thirty minutes, we were told, was the longest period during which boys could concentrate their attention and work effectively. This failing, I believe, is not unknown in our own schools.

Public High Schools.—Although we have no schools which are the precise equivalent of these, some of our higher grade elementary schools come very close to them in many respects. It is noteworthy that, in a city like New York, few who can afford to send their children to private schools make use of the public high school—one chief reason assigned being that the classes in the latter are so large that individual pupils can not receive sufficient attention. Of those who enter, in New York, about fifty per cent. (mostly boys) leave during the first year to go into business; under ten per cent. remain until the fourth year. It is said that a much larger proportion are retained in the schools in the middle west.

In common with all my colleagues, I was favorably impressed by the way in which English literature was taught, but I could not discover that the teaching was carried to a logical end and fondness for reading inculcated.* I found no more evidence that proper attention was paid to writing and English composition than in our schools; the subject which of all others is of primary importance seems to be equally neglected in both countries. I met with no proper attempt to correlate the English composition with any of the practical work.

In the teaching of mathematics and science, the American high schools seem to me to be considerably behind our best schools. I came across little evidence that the practical methods of teaching mathematics and geometry which are coming into vogue here are appreciated; and the old academic methods of teaching science seem to prevail almost exclusively. No proper foundation for such work is laid in the elementary schools.

In one respect there has been an important departure: the recognition of the value of manual training has led to the development of a special manual training department and, in some cases, of distinct manual training high schools; in the latter, manual training takes the place of classics. In some cases, perhaps the majority, these are tending to develop into trade schools and to aim at proficiency in wood and metal work; they are elaborately equipped with tools. Nominally, they profess to regard the manual work from an educational standpoint, but it is quite clear that in most cases the will passes for the deed and that the teachers are not competent to develop the subjects pedagogically.

But we met with one most remarkable

* In the new Morris High School in New York—a magnificent building to accommodate nearly 3,000 pupils—a very fine library will be provided. The head master told us that it was his intention to develop the use of this systematically and that many duplicates would be provided of important books. A feature in this school will be a permanently darkened class-room with electric lantern, etc., into which classes can go to witness lantern demonstrations in connection with geography lessons, etc.

exception in the Brooklyn Manual Training High School. The head master of this school, Mr. Larkin, has conceptions of the educational possibilities which manual training may afford which place him on a special plane. His school at present is very inadequately housed. New buildings, however, are to be provided, and it is to be hoped that these will not be so palatial and ornate as to destroy the true workshop-like character and atmosphere of the cramped quarters in which the work is now carried on. In the first year the boys do woodwork; in the second, metal work—chiefly forging; in the third, printing; in the fourth, machine-tool work. The second-year work was in the hands of a man of exceptional ability, not merely a smith, but an artist, so that the imagination as well as the mechanical aptitude of the boys was being well developed. The printing was in charge of a master who also taught chemistry in the school—an enthusiast who had mastered the art of printing and was teaching it *con amore*. Ocular demonstration of his persuasive powers was afforded by the presence in the workshop of a valuable linotype machine, which he had induced the makers to present to the school. We met with another man of this type teaching woodwork at a high school in Washington. He had been educated in the school and, perceiving the importance of the subject, had served for several years as a pattern-maker in the Navy Yard at Washington; then he had returned to the school as a teacher.

It is men such as these that are needed to put manual training on a proper footing—and it is all important that we should devise means of attracting such men into schools.

The introduction of printing as a school subject may appear altogether absurd, but Mr. Larkin gave us clear evidence in proof of its value. Not only, he argues, is it of importance as a manual, mechanical exercise, as the means of bringing lads into contact with a set of facts outside ordinary experience, as well as of familiarizing them with all that is involved in the production of the books they read, but it is also of value on the literary side. When lads are called upon to set up in type and print off something that they have written and to correct the proof, they begin to realize, in a way which is rarely done by the mere writer, how careless they have been in writing, how poor their style. We were favored with copies of a journal produced in the school—printed and illustrated there—which certainly gave evidence of great skill. Mr. Larkin has a true conception of the educational possibilities afforded by proper manual training: while depreciating the attempt to train up skilled workmen as tending to stereotype the teaching, he sees very properly that it affords opportunities both on the mechanical and artistic side for general culture and that it may be made a most important adjunct of the literary and scientific work. Had I enjoyed no other opportunity than that of meeting him and of learning his views, I feel that my visit would have been a fruitful one.

But elsewhere I found an almost absolute lack of imagination underlying the manual training work—vague ideas of possibilities but neither real understanding nor sufficient executive power—although technically much of it was excellent.

It may be hoped that manual training schools—both primary and secondary—will soon be established here in which at least half the time will be spent at experimental and manual work. There is no more important experiment to be made in education that that of determining the value of such schools. In these schools a whole floor at least should be fitted up as a workshop and every kind of manual work

should be carried on, so that there might be *unlimited manual temptation* in the path of the scholar, who should be free to attempt anything that he liked without following a routine course.

School Management.—It is generally known that the American school system is very ineffectively controlled at the present time and that it is too often dominated by political influences. This is well brought out in a recent article in the *Forum* for October to December, 1903. In New York, both the elementary and the high schools are controlled by an able city superintendent, who has a staff of inspectors under him, and all appointments are made on a civil service basis; but a year or two hence, I believe, a Tammany-appointed inspector may be his successor. All the schools work to programs authorized by the superintendent, one program being laid down for the elementary, another for the high schools. The latter, however, is based on the elective system, a considerable range in the choice of subjects being allowed. There is no doubt that this system is subject to considerable abuse and that 'soft options' are much in request. It is beyond question most desirable that special aptitudes should be developed and that teachers should be in every way mindful of these; but boys and girls can not always be judges of what is good for them, nor have they the necessary worldly knowledge to settle for themselves. The Americans do not seem to have settled any more than we have what are the necessary elements of a rational course of school study.

As they work to a common program, both the freedom of the high schools and the responsibility of their directors are limited in a way altogether unknown here, perhaps to an unfortunate extent. Given an ideal superintendent with an ideal staff, the system might work well. But no special effort is made or is likely to be made to secure such an ideal executive; yet it should be aimed at. The combined intelligence of the teachers must be in excess of that of the executive and it should be brought more into operation; unless the Americans desire to stereotype all teaching, they must be prepared to grant almost absolute freedom to their teachers. This does not preclude either the holding up of example or fair criticism. Both here and there the spirit of cooperation needs to be brought effectively into action. Our education department hitherto has had no intelligence department; it has had no clearly thought-out, definite educational policy; there has been no effective means of keeping the inspectorate informed on all matters relating to educational method and no recognized means whatever of securing exchange of opinion and discussion either among the inspectors themselves or between them and teachers at large. The work of education has been carried on in holes and corners into which outside influences have penetrated with difficulty. In both countries we need to organize the work on a scientific basis; there should be some conscious effort made to substitute the good for the bad and even for the mediocre.

Female Teachers.—Most of us who are conversant with school work were struck by the distinctly low average of attainment in the American high schools. To what is this attributable? In part probably to the conditions which prevail in American life; but in large measure also, I venture to think, to the prevalence of mixed schools and the preponderance of women teachers.

Admitting that it may be possible, even desirable, to bring up the two sexes together in the earlier years of school life, I venture to think that we must sooner or later come to admit that it is wrong to do so during the later years, if the object be to develop a virile man. To put the matter in very simple terms, it seemed to me on

the occasion of my former visit—and the impression was confirmed during my recent visit—that the boy in America is not being brought up to punch another boy's head or to stand having his own punched in a healthy and proper manner; that there is a strange and indefinable feminine air coming over the men; a tendency towards a common, if I may so call it, sexless tone of thought.

But if coeducation be bad in itself, it becomes infinitely worse when the teachers are mostly women; they should rather be men mostly. Nowhere is the claim on behalf of women to equality with men put forward so strongly as it is in the United States. Nowhere, I believe, would it be found to be more disproved in practise, if carefully inquired into. Women have sought in recent times to prove that they can compete successfully with men in every field; they claim to have succeeded, but the claim can not be allowed, I think. They have shown—what it was unnecessary to show—that they are indefatigable workers; and they have shown that they can pass examinations with brilliant success. But what has been the character of the examinations? Almost invariably they have been such as to require the reproduction of learning, not original effort. History records but very few cases of women with any approach to originality; it proves the sex to have been lacking in creative and imaginative power. Those who have taught women students are one and all in agreement that, although close workers and most faithful and accurate observers, yet, with the rarest exceptions, they are incapable of doing independent original work. And it must be so. Throughout the entire period of her existence woman has been man's slave; and if the theory of evolution be in any way correct there is no reason to suppose, I imagine, that she will recover from the mental disabilities which this has entailed upon her within any period which we, for practical purposes, can regard as reasonable. Education can do little to modify her nature. The argument is one which women probably will not, perhaps can not, appreciate. No better proof could be asked for, however, than is afforded by the consistent failure of women to discover special wants of their own—they have always merely asked to have what men have, to be allowed to compete with men. Domestic subjects have been taught in the most perfunctory manner possible.

Among the colleges we visited was that of Vassar—the chief college for women in the states. It accommodates some 900 students. The college is located amidst surroundings in full harmony with the grace of the inmates; their charm of manner overcame us completely, even in the brief period during which we were privileged to fraternize with them. The teachers are mostly men. The instruction is given entirely on academic lines; lectures are delivered on economics, but I could not discover that woman's work in the world—'domestics'—was considered in any specific way; it would come, I was told, under the head of technical education, which is eschewed. Apparently no use is made of the beautiful grounds in which the buildings are placed for nature-study or instruction in horticulture; as one of my companions remarked, nature is looked at only in the laboratory down a microscope tube.

In some of the western coeducational colleges, arrangements have been made to provide for woman's specific requirements, which have given great satisfaction, I am told; but this has been done at the instance of the men teachers.

The women teachers in America, it seems to me, are less likely than ours are to take a feminine point of view in instructing

girls. The general environment seems unfavorable to the development of domestic tastes.

From the point of view that I have ventured to advocate, women teachers must be, for most purposes, relatively inefficient; and as teaching is an occupation in which more than any other imaginative power, individuality, insight and originality are wanted, it is important that men rather than women should exercise the predominant influence. If it be the province of education to mold the race, there is no other question of greater importance claiming our attention at the present time—especially as the difficulty of obtaining male teachers is increasing day by day. In both countries it is imperative that we should discover means of attracting men with practical instincts and of superior mental gifts into the teaching profession.

The Training of Teachers.—The elementary schools, at least in the larger cities, enjoy an advantage over ours in that, I believe, their teachers usually all pass through a period of high school training prior to entering the normal or training school; their outlook is consequently, on the average, somewhat broader. The methods adopted in training teachers appear to be no less academic than ours.

The premier training establishment at the present time is the Columbia Teachers College, New York—a palatial establishment. The teaching given in this college is in part academic, in part professional, the predominant class of student being those who are training to become supervisors, *i. e.*, advisory or teaching inspectors.

I had hoped to find that in this college the academic training had a certain bias imparted to it, just as at our Cambridge a certain professional bias is given to much of the academic training of those who graduate in the engineering tripos. But I was disappointed. And I was also greatly disappointed by what I heard when attending some of the pedagogic classes; there was a high-flown air of unreality about the instruction; too much precept, too little practise; no really severe practise! The whole building seemed to me to be out of character with the work to be done; far too ornate; and the students—mostly women—looked far too respectable and tidy to please me. If they had been men I should have said that they needed to take their coats off and not to be above making their hands dirty. It does not seem likely that teachers so trained will be able to give the simple, practical, common-sense instruction that boys and girls stand so much in need of at the present day. The whole appeared to me to be a good illustration of the tendency that I seem to see in America to be guided by sentiment and emotion, and to work on academic rather than on practical lines. I do not think that the Americans can long claim to rank as a practical nation if such methods are allowed to prevail.

We have sinned and are sinning grievously here in the same way, but there are clear indications that we have recognized our mistake, and that we may shortly enter upon a new era in which common sense will prevail. I saw no such signs in America.

College and University Instruction.—Even if it were necessary it would be difficult to arrive at any consistent definition of the American college; but as a rule it may be said to aim at giving a liberal education rather than professional training. Where colleges or schools for both purposes exist, side by side, they together constitute the university. It is noteworthy that, with a few exceptions, the term university has only recently met with general application; Yale College, for example, obtained the

right to call itself Yale University only in 1887.

The college and university instruction, including that given in technical schools, is of interest to us at the present time from several points of view.

In the first place, in America, as here, great complaint is made that students come to college ill-prepared to do the work;* that games† occupy too large a share of attention; and that the bonds of discipline have been unduly slackened of late years.

Moreover, it is said that those who have been brought up in towns are not such satisfactory students as those who have been brought up in the country. The latter are not only more earnest but more practical. On this account the spirit prevailing in some of the western colleges is said to be far better than that met with in many eastern colleges.

Although the elective system prevails very largely in those cases in which graduation from college is a necessary preliminary to professional study, the course is prescribed. It is very noteworthy that the course laid down is a broad one. Thus at the Johns Hopkins University, the following are the subjects prescribed in the chemical-biological or preliminary medical group:

	Hours Weekly.
First Year.	
Physics	9
Chemistry	9
Rhetoric	3
English Composition	4
Second Year.	
Chemistry	9
Biology	9
French	4
English Literature	3

* Professor J. J. Stevenson, of New York University, deals in a very outspoken manner with this question in the recent January number of *The Popular Science Monthly*. To quote a few sentences from his article: "The old adage says 'he who would command must first learn to obey.' That American lads are sorely in need of such training is only too evident. * * * Such training means—training to think, to reason. Lads too often fail to receive this training in secondary schools, as any instructor who has had to deal with freshmen can testify. Secondary schools to-day are little better than cramming houses to fit pupils to answer odds and ends of questions in papers for entrance examinations. Loose thinking and restlessness under restraint characterize the American students in the lower classes at college; lack of home training may be responsible in part for the latter characteristic, inferior teaching in secondary schools for the former."

† The report of the President of Harvard College for the year 1901–1902 contains for the first time the report of the chairman of the committee on the regulation of athletic sports. President Eliot's comments thereon are highly instructive: "This report is interesting from several points of view. It exhibits, in the first place, the large number of students who are actively engaged in the competitive sports taken together. The figures given are not accurate, but it is reasonable to suppose that at least two thousand students out of the thirty hundred in Cambridge take some active part in one or more of the thirteen sports in which an enumeration of the number of participants was made. * * * The chairman calls attention to the fact that the expenditures for football are steadily increasing. A quarter part of all who take part in this sport are injured enough to lay them up for ten days on the average, and a much larger proportion of those who really play the game are thus injured for the season. The changes in the rules during the past ten years have tended to increase the number of injuries rather than to diminish it. The temporary injuries are so numerous that it is impossible to count on putting any particular eleven men into an important game on a given day. In order to provide the necessary number of substitutes for each place, the football squad often numbers sixty men. Hence large expenditures. The outfit for candidates grows more expensive, because they wear about fourteen pounds weight of padding and armor. On the whole, the game, under the existing rules, tends to become slower and less visible in its details, and therefore less interesting. Moreover, the ethics of the game, which are the imperfect ethics of war, do not improve. The martial axiom—attack the enemy's weakest point—inevitably leads to a deliberate onslaught on the cripple or the convalescent in the opposing line; and the habitual violation of rules, if penalties be escaped, is regarded by many as merely amusing."

Third Year.

Biology	9
Philosophy	5
History and Economics	4
Elective Course	2

English composition and reading, French and German, as well as economics, are included in all the complete engineering and science courses at the Case School of Applied Science, Cleveland, Ohio. The same practise is followed at the Massachusetts Institute of Technology, where, in addition, history (American and European) figures in the program. In these institutions the course lasts four years. The course of reading prescribed in the Case School is an instructive one.

I inquired specially into the teaching of English composition. At the Massachusetts Institute the instructor was taking the utmost pains to select themes likely to interest engineering students; but the possibility of directly correlating the laboratory work with the literary work had not been contemplated.

It appears to me that we may well take a leaf out of the American book and introduce an element of literary study into our engineering courses; but when the question is considered, I trust we shall endeavor to correlate the literary work very closely with the practical work. I did not discover that American students are any more willing to read studiously than ours are.

HENRY E. ARMSTRONG.

LONDON.

(To be continued.)

JOHN BELL HATCHER.

AMERICAN paleontology has suffered an irreparable loss in the untimely death of Mr. Hatcher, which took place, after a short illness, at Pittsburg on July 3.

John Bell Hatcher, the son of John and Margaret Hatcher, was born at Cooperstown, Illinois, October 11, 1861, but at an early age was taken by his parents to Greene County, Iowa, where they settled permanently, and where he received his early education. As a boy, he provided for future college expenses by working as a coal-miner and what he observed in the mines directed his attention and interest to the problems of geology. In 1881 he entered Grinnell College, Iowa, and, after remaining there for three months, he became a member of Yale University, graduating in 1884. His undergraduate years were devoted to the study of the natural sciences, and especially to geology and botany. Some collections that he had brought with him from Iowa attracted the attention of the late Professor Marsh, who appointed Hatcher, immediately on his graduation, as his assistant and at once sent him to the western field to collect fossil vertebrates.

Thus began a career which was unrivalled of its kind, for Hatcher had a positive genius for that particular work, as is well known to all who have had the privilege of accompanying him in the field. Marvelous powers of vision, at once telescopic and microscopic, a dauntless energy and fertility of resource that laughed all obstacles to scorn, and an enthusiastic devotion to his work, combined to secure for him a thoroughly well-earned success and a high reputation. He may be said to have fairly revolutionized the methods of collecting vertebrate fossils, a work which before his time had been almost wholly in the hands of untrained and unskilled men, but which he converted into a fine art. The exquisitely preserved fossils in American museums, which awaken the admiring envy of European paleontologists, are, to a large extent, directly or indirectly due to Hatcher's energy and skill and to the large-minded help and advice as to methods and localities which were always at the service of any one who chose to ask for them.

Hatcher's uprightness and sincerity of

character, no less than his remarkable energy and persistence, attracted to him the admiration of many western men, by whom frequent tempting offers were made him to leave the unremunerative paths of science for the material rewards of business, but in vain. He would not seriously consider the abandonment of his chosen work for any reward whatever and he died in harness.

In 1887 he married Miss Anna M. Peterson, who, with four children, survives him.

Hatcher's work for Professor Marsh and the U. S. Geological Survey continued for nine years and though, in 1890, he was appointed an assistant in geology in Yale University, he kept up his field-work with unbroken success, amassing a very large part of the enormous and invaluable collections which are stored at New Haven and Washington.

He accepted, in the spring of 1893, a call to Princeton University as curator of vertebrate paleontology and assistant in geology and at once threw himself into his new duties with characteristic ardor. For the three summers of 1893–5 he conducted field-parties of students through large parts of Utah, Wyoming and South Dakota and, with all of his old interest and skill, gathered priceless collections of mammals from the Uinta, White River, Loup Fork and Sheridan beds, accomplishing wonders, in spite of the scanty resources which sadly hampered his plans. His students became his enthusiastic friends and admirers, glorying in the courage and devotion which overcame every obstacle, material or moral. In return, Hatcher took the warmest interest in his students, especially in those who were struggling against difficulties to secure an education; in the quietest and most unostentatious way he was continually devising effective means to help such students to help themselves and thus enabled them to continue their studies without any impairment of their self-respect.

The most important work which Hatcher undertook during his connection with Princeton was his exploration of Patagonia in the years 1896 to 1899. The plan was all his own and was not proposed to the geological department until everything was nearly ripe for action; he secured the greater part of the necessary funds and, with characteristic generosity, was himself a liberal contributor. How successful this great undertaking was is very generally known and needs not to be repeated here. Great credit for this success is due to Messrs. Peterson and Colburn, who were associated with Hatcher in the work, but the soul of the enterprise was Hatcher himself. In his 'Narrative of the Expeditions' he has left an extremely well-written and interesting account of these explorations, which, however, gives the reader but an inadequate conception of the difficulties and perils which beset him, and of the boundless energy and courage with which those difficulties were met and overcome. Painful wounds, dangerous sickness, indescribable suffering, the hardships due to a severe climate and a savage wilderness and to inadequate equipment, in vain combined to turn him back, though he was twice compelled to return home for short periods of rest and recuperation. In the history of scientific exploration there are few chapters recording truer heroism and achievement than Hatcher's journeys through Patagonia.

The principal object of the expeditions was to gather the most extensive possible series of the fossil mammals for which Patagonia has been so famous since the days of Darwin's 'Voyage of the Beagle,' and next to determine the stratigraphical succession of the beds in which these fossils occur. This involved extensive explora-

tions of regions where no white man had ever been before and brought to light much geographical information. At the same time, the plants and recent animals were collected, so far as it was possible to do so without sacrificing the principal end in view, and in these departments also an unexpected measure of success was attained, and a representative series illustrating the botany, zoology and paleontology of Patagonia was secured.

Hatcher then conceived the plan of publishing together in one uniform series of reports, by the hands of different specialists, all these results, which would otherwise necessarily appear in separate form, scattered throughout the various technical journals. This plan was submitted to Mr. J. Pierpont Morgan, and to his liberality it is due that this cherished scheme is now in process of realization and in a manner surpassing the hopes of its original proposer. In addition to the 'Narrative and Geography,' Hatcher had undertaken to write reports upon the geology and also upon the fossil Litopterna and Marsupialia. How much of this material can be put into shape for publication can not yet be told. In any event, he has raised for himself an enduring monument in these volumes, which owe their existence to him, however much or little may be his verbal contribution to their contents.

Hatcher finally returned home (little as he believed it to be a final return) in the autumn of 1899 and in the following February he accepted a position as curator of vertebrate paleontology in the Carnegie Museum at Pittsburg, a position which he occupied till his death. With undiminished interest and zeal he took up the larger and more exacting duties of his new sphere and conducted his work with distinguished success. Paleontologists all know with what remarkable rapidity the collections of the Carnegie Museum have grown within the last four years and what a wealth of noble material has been brought together there, much of it unsurpassed in the world. No less than three great collections thus owe their choicest treasures to the skill and devotion of Hatcher.

It would, however, be creating a very false impression to let the reader suppose that Hatcher was entirely or even mainly a collector. For a long time he modestly held back from bringing his own observation and inferences before the scientific world and from this comparative seclusion he was late in emerging. He had been well trained and he had enjoyed great experience in years of field-work over a vast territory in two continents; more than this, he possessed a singularly original and independent mind and the keenest powers of observation, and these gifts, combined with his wide opportunities, led him to many novel and important conclusions in dynamical and stratigraphical geology, only a very small part of which has yet been published. The paleontology of the vertebrates was the field in which he took the deepest interest and in which he has published most, his papers dealing principally with mammals and reptiles. These papers show the ability which he brought to his subject and there seemed every reason to hope that his unresting activity might continue for many years and that the harvest would correspond to the long and laborious period of preparation. But this hope has been denied; Hatcher was cut off just when his powers and opportunities had reached their fullest development and the boundless field, in which he so loved to work, lay open and unrestricted before him. When his last illness attacked him, he was engaged upon a monograph of the Ceratosauria for the U. S. Geological Survey, upon the monographs for the Patagonia

Reports above mentioned, as well as upon several papers for the publications of the Carnegie Museum.

It is a pathetic coincidence that the words which Dr. Dall applied in this journal to the late Professor Beecher should so soon find an exact application to Beecher's former colleague in the Yale Museum: 'The ranks of those capable of bringing to the study of fossils keen insight and a philosophical spirit of inquiry, guided by principles whose value can hardly be exaggerated, are diminished by one whom science could ill afford to lose, and to whom, humanly speaking, there should have remained many years of industry and fruitful research.'

W. B. Scott.
Princeton University.

SCIENTIFIC BOOKS.

Adolescence; its Psychology and its Relations to Physiology, Anthropology, Sociology, Sex, Crime, Religion and Education. By G. Stanley Hall. New York, D. Appleton and Company. 1904.

The range of President Hall's two volumes is even wider than the title announces. Besides the topics there indicated, the book contains an outline of the author's general psychological system, a philosophical *credo,* and multitudinous comments on the psychology of early childhood and adult life. The thirteen hundred and more pages are somewhat evenly divided among physical, psychological, social and miscellaneous phenomena. The author's division is as follows:

Volume I.—Growth in height and weight, 50 pages; growth of parts and organs during adolescence, 78 pages; growth of motor power and function, 108 pages; diseases of body and mind, 88 pages; juvenile faults, immoralities and crimes, 86 pages; sexual development: its dangers and hygiene in boys, 61 pages; periodicity, 41 pages; adolescence in literature, biography and history, 77 pages.

Volume II.—Changes in the senses and the voice, 39 pages; evolution of the feelings and instincts characteristic of normal adolescence, 55 pages; adolescent love, 49 pages; adolescent feelings toward nature and a new education in science, 88 pages; savage pubic initiations, classical ideals and customs and church confirmation, 49 pages; the adolescent psychology of conversion, 82 pages; social instincts and institutions, 86 pages; intellectual development and education, 112 pages; adolescent girls and their education, 87 pages; ethnic psychology and pedagogy, or adolescent races and their treatment, 101 pages.

The student will naturally divide the book as a whole into: (1) An array of facts bearing upon its topics, (2) an attempt to establish a parallelism between the mental development of human individuals and that of the whole phylum at one extreme of which they stand and (3) the author's educational recommendations. The reviewer will follow this division.

The array of facts presented implies an astonishing labor in reading, selecting and condensing. Over two thousand writers are quoted or referred to. Whoever has made any pretense of saying a scientific word about the rich life of concrete human nature, we may expect to find summarized. Be it the love of children for cats or growth of thoracic capacity or the lives of the saints, President Hall is equally ready with varied comment and plenteous references. No one person could estimate the completeness, accuracy and relevancy of this body of information as a whole. If the citations and summaries under each topic do represent adequately the views of the experts, President Hall's tremendous zeal will result in a corresponding saving of time and gain in insight for future students. If they do not, very many will be misled. In any case the array of information will, in these volumes as in the author's teaching, stimulate and suggest. In those fields where the reviewer could presume to judge, there appears an unhappy tendency toward the selection of authors and extracts which fit President Hall's own prepossessions. And this suspicion is too frequently confirmed in cases where expertness is not requisite. We tend to lose confidence in no matter how eminent a scholar, when, in a description of 'Adolescence in Literature and Biography,' he gives a thousand words to a summary of Mary Mc-

Lane and not one to the masterly descriptions of youth by George Meredith; or when he brushes aside James's 'Varieties of Religious Experience' as the work of a 'brilliant litterateur' who 'lays on colors with a trowel' and 'throws scientific caution to the winds.'

It was to be expected that the author would use, at their face value, the replies to printed questions written by children and normal school students and those interested enough to reply. Although he is probably the only one of the score of most eminent psychologists who put any trust in such replies, President Hall's confidence is serene and he does not even deign to justify his choice of a method so universally rejected by his peers.

The second chief aim of the book, to show how human life in general and adolescent mind in particular demand a comparative and genetic psychology as their explanation, is fulfilled to the extent of demonstrating and richly illustrating the fact that human nature in mind as in body bears traces of its long savage and animal ancestry. Although the author is, perhaps, brutal in his reproaches against the mere analysis of mental states, he is surely right in asserting the need of a true natural history of mind and in seeking to base theories of human behavior upon a dynamic rather than a static psychology. So much is irrespective of the particular connection which he believes to exist between human mental life as we know it to-day and the mental history of the long line of our ancestors; namely, the recapitulation by the individual of his phylum's evolution. It is impossible for the reviewer to discover just what the recapitulation theory means to President Hall. At times he seems to agree with the thoroughgoing parallelism stated by G. H. Schneider a score of years ago; at times the logical outcome of his concrete illustrations can be hardly more than a general continuity between human and animal instincts and capacities. In general he may fairly be said to explain any similarities between present and ancestral conditions by a recapitulatory tendency rather than by similarity in conditions and to seek constantly for such similarities. Many of his explanations are so purely speculative as to weaken his argument. One is amused more than edified by reading that the 'candle-light fever,' the excitement of children before bed-time, may be 'the reverberation in modern souls of the joy that in some prehistoric times hailed the Prometheus art of controlling fire and defying night.' And what can he mean by offering as evidence of mental recapitulation of a piscine stage the fact that the whales and others have changed from terrestrial to marine life (see Vol. II., p. 195)? And does not the argument become a trifle intricate when the fear of water and the love of water and the sitting 'by the hour seeing and hearing the movements of water in sea and stream' all prove recapitulation?

President Hall's educational recommendations will be read by many who will skip his summaries of facts and misunderstand such of his psychological speculations as they do not forget. They are the most personal and heartfelt portions of the book, with the exception of the eulogy of adolescent love, and will refresh many a student wearied by modern pedagogy. His fundamental principles are sufficiently startling. The tendency of evolution, in other words, the probable future, should be the goal of human effort. Morality is simply being up to and ahead of the times. The survival of a race proves the moral fitness of the individuals composing it; therefore, educate people to survive and propagate. You thus improve them. Delay the age of nubility, because the germs inherit the acquisitions of the individual, nay more, inherit the natures of previous ancestors only as the individual reacquires them. The latest stage in evolution is your goal, but omit no one of the earlier stages, for each is a *sine qua non* for the next. To be rid of a trait in later life cultivate it for a time in youth. But if you don't dare to let children be cruel and quarrelsome, at least let them contemplate these traits in literary or dramatic presentations.

In concrete recommendations the influence of this amazing creed is outweighed by that of President Hall's great practical wisdom and sharpest insight into the follies of our present traditionalism. The readers of this journal deserve, in the case of his comments on sci-

ence in the schools, a more detailed review than has been possible of the book as a whole. "Science should be taught first in a large, all-comprehensive way, not without a distinctly religious spirit." In childhood and youth we should encourage the 'sentimental response' to nature. Then should come popular science with many object lessons and stories of the heroes of science. Then the applications of science; 'the practical technological side of science should precede its purer forms.' 'Last and highest comes pure science.' For example, in physics teach boys and girls much about the heroes of science and the drama of research, diminish quantitative work, be more superficial for the sake of harmony with the recapitulation theory, make large use of mechanical toys, photography and the like. Let astronomy declare the glory of God rather than of precise measurements. Let biology emphasize life activities and the general theory of evolution. In general President Hall's destructive criticism of present high school text books of science, in which the man of science seems to postulate that what he happens to know and be interested in is what school-boys should learn, is stronger and will be more profitable than his positive suggestion that we revert to the personification of animals, ecstasies over nature and the goodness of God, and superficial cosmologies. The superficial cosmology has, perhaps, more in its favor than the present generation of men of science will admit. But it seems to entail rote memorizing as a method of study.

Two general features of the volumes, one of content and one of style, it is the reviewer's duty to note. The acts and feelings, normal and morbid, resulting from sex are discussed in a way without precedent in English science. To realize the material presented one must combine his memories of medical text-books, erotic poetry and inspirational preaching. Witness the following: "Every gemmule is mobilized and the sacred hour of heredity normally comes when adolescence is complete in wedlock and the cerebro-spinal rings up the sympathetic system, and this hands over the reins to the biophores and germ cells, which now assert their dominance over those of the soma. In the most unitary of all acts, which is the epitome and pleroma of life, we have the most intense of all affirmations of the will to live and realize that the only true God is love, and the center of life is worship. Every part of mind and body participates in a true pangenesis. This sacrament is the annunciation hour which the whole world reflects. Communion is fusion and beatitude. It is the supreme hedonic narcosis, a holy intoxication, the chief ecstasy, because the most intense of experiences; it is the very heart of psychology, and because it is the supreme pleasure of life it is the eternal basis and guarantee of optimism. * * *

"Reproduction is always sacrificial. Man learns to live by dying and his life is at best a masterly retreat. Relaxation and detumescence are the first faint symptoms from afar of senile involution and the Nemesis of death, toward which the individual shrivels. After the high tide in which the *ars amandi* culminates, lifting existence, like the great bore on the Chinese rivers, the law of *post coitum triste* is gradually accentuated with increasing years. Now man truly knows good and evil, euphoria and disphoria, and is polarized to pleasure and pain."

The feature of style is a baffling junction within the same paragraph, or even sentence, of statements which to the commonplace mind have no logical connection. The extraordinary range and vivacity of the author's interests are probably the cause. But some sacrifice should have been made to the commonplace thinker who will puzzle long and, perhaps, in vain to see the unity or logic of the hundreds of passages like the following: "The chief reason why our Bible is the best of all ethnic Bibles is because it is so deeply based upon genetic truth. The story of creation is full of ancient and subtle symbols of divine generation. The tale of Eden and the fall, whatever historic validity it may or may not have, is a masterly allegory of the first stage in the decadence of love. Abraham, a nomad sheik, was a breeder of cattle, and the promise was that he should be a breeder of men like the stars of the heavens for multitude. Circumcision was a hygienic measure of great

efficacy, as we shall see, as well as a covenant. The long wars with the Canaanites and Baal worshippers were conflicts with phallicism, to the gross orgies of which the chosen people were always lapsing. All early Hebrew history shows that while man knows how to breed cattle, Jehovah could breed men, and it is a study of human heredity far more effective than Plato knew how to make it. The New Testament begins with the annunciation and conception from on high, and a nursery scene of moving bucolic power, while Islam hypostatizes only the former." And what strength is added to a eulogy of wrestling by the last clause of this sentence: "The very closeness of body to body, emphasizing flexor rather than extensor arm muscles, imparts to it a peculiar tone, gives it a vast variety of possible activities, developing many alternatives at every stage, and tempts to many undiscovered forms of mayhem." These two samples were taken practically at random, but one puzzling association so rings in the reviewer's ears that he must allow it a motor discharge. It concerns the psychology of prison life and is, "Not only men, but women fall* in a school-girl mash, but women can not organize or complot."

EDWARD L. THORNDIKE.
TEACHERS COLLEGE,
COLUMBIA UNIVERSITY.

SCIENTIFIC JOURNALS AND ARTICLES.

THE leading article in the *Journal of Comparative Neurology and Psychology* for June is 'An Enumeration of the Medullated Nerve Fibers in the Ventral Roots of the Spinal Nerves of Man,' by Charles E. Ingbert, a direct continuation of the same author's former enumeration of the dorsal root fibers of man. An extensive discussion of the areas of the cross-sections of each root, the number of fibers per square millimeter of the cross-sections and the relation between the dorsal and ventral roots is followed by figures and tabulations giving the data for each fascicle of each nerve root. There are 203,700 medullated nerve fibers in the ventral roots of the left side and 653,627 in the dorsal roots, these numbers being in the ratio of 1:3.2. In the white rat this ratio is 1:2.3 and in the frog 1:1.2, indicating that probably the relative sensory supply increases as we ascend in the zoological series.

* The actual text is *pall*, which to the reviewer makes a truer statement, but the context suggests the correction.

SOCIETIES AND ACADEMIES.

THE TORREY BOTANICAL CLUB.

THE meeting of May 10, 1904, was held in the library of the New York College of Pharmacy, Rev. L. H. Lighthipe presiding.

The first paper on the scientific program was by Dr. H. M. Richards, entitled, 'Notes on the Peat Bogs of Ireland.' The peat bogs have been variously estimated as covering from one fifth to one tenth of the surface of Ireland; probably the larger estimate is excessive.

Dr. Richard's observations at several points on the west coast including Donegal and Achill Island were given. The basis of the bogs is not always the same, but in some cases it is glacial gravel. The thickness of the peat varies from one or two feet to forty feet, but no exposures of more than twenty-five feet thickness were seen. On the slopes and hillsides the peat is thinner, but becomes accumulated in the lower situations so that the thickness of the bog does not necessarily show its age. Bogs have been known to burst, as in Sligo, in 1831, and to do considerable damage to houses below them.

The peat is mostly vegetable matter and yields very little ash. According to Lyell, its formation is supposed to be due to the low temperature preventing complete decomposition of the vegetable matter. Peat is not formed in warm countries and the additions to the beds are made in cold weather. In the bogs seen there was standing water only in the holes and ditches, but the soil was wet and soggy. Comparatively little of the bog oak is found. Some of the stumps are in place, showing that they are not driftwood carried into the bog. The dark color and hardness of the bog oak are said to be due to the action of a diatom, a *Melosira*, and the formation of bog iron ore is supposed to be due to the same

diatom. It was suggested that part of this action may be due as well to *Crenothrix*. There is little of vegetable remains except at the top of the bog. *Sphagnum* makes up a comparatively small part of the peat bog vegetation as seen in the localities mentioned, and sphagnum peat is not so highly prized for fuel. A small *Carex* seemed to be the principal peat forming plant. Two species of *Drosera* grow in profusion and the heather and ling thrive very well and contribute considerably to the peat. *Pteridium* and several small ferns are rather common. *Sphagnum* and many fresh-water algæ grow in the holes and ditches, and from such places West has made fine collections of algæ, especially desmids. Peat bog soil has been found to be very sterile and at least two years are required to reclaim it, the method including throwing it up and exposing it to the air, and the application of fertilizers and lime. The cause of this sterility is not clearly understood, and is, perhaps, due to the lack of some of the necessary mineral salts and to the fact that the nitrogenous materials may not be in the best available form for plant nutrition. Some of the reclaimed peat bogs are very fertile lands, but if neglected they quickly run back to their sterile condition. If cultivation ceases, the *Pteridium*, heather and carices come back in a few years.

The second paper of the evening was by Dr. Marshall A. Howe, under title of 'Remarks on some West Indian Marine Algæ.' The remarks were based chiefly upon specimens collected by the speaker in March and April of the present year on the Florida Keys and the Bahama Islands, supplemented by specimens from Bermuda and Porto Rico and also by some obtained on a previous visit to Key West. The discussion was confined to the families Caulerpaceæ and Codiaceæ, members of the order Siphonales and class Chlorophyceæ. The family Caulerpaceæ, according to the more recent writers, consists of the single genus *Caulerpa*, with probably sixty or more well-defined species, including plants of a great diversity of form and habit. Some of the earlier phycologists, impressed by these evident differences, suggested generic segregations, and it is probable that some of the proposed genera are as well limited as are many of the current genera among the Agaricaceæ. There is, however, not such an unwieldy number of species to afford an excuse for generic splitting as is the case with the agarics, and there is practically nothing but habit and external form to lay hold of in limiting species and attempting generic segregations. Specimens were shown illustrating the principal sectional or subgeneric groups.

The Codiaceæ were illustrated by specimens of *Codium, Avrainvillea, Penicillus, Rhipocephalus, Udotea* and *Halimeda*. The genera *Penicillus* and *Rhipocephalus* are especially well represented in the Bahama Islands. Four species of *Penicillus* and two of *Rhipocephalus* were shown, all of which were found growing within a mile radius in Bemini Harbor, Bahamas. One of these is supposed to be the species described from the Bahamas by Decaisne in 1842 as *Penicillus oblongus* and apparently not met with in the meantime. This species was transferred to the genus *Rhipocephalus* by Kuetzing. In reality it stands between the genera *Penicillus* and *Rhipocephalus* and weakens the distinction between them. It is easily a *Rhipocephalus* when it is young, but as it gets older becomes more like a *Penicillus* and might then be casually passed by as a form of the common *Penicillus capitatus*. The head, however, is usually more oblong than in that species, the branching of the threads of the brush is characteristic and the arrangement of the threads in the apical or younger part of the brush is always distinctive.

Among the species and forms of *Halimeda* exhibited was one from the Florida Keys which is soon to be described as a new species. This has been confused with *Halimeda Tuna* by both American and foreign students of the genus, but is readily distinguished from that and other described species by the fact that the surface of each cortical tube or 'cell' is drawn out into a strong spine.

William T. Horne,
Secretary pro tem.

DISCUSSION AND CORRESPONDENCE.

THE METRIC SYSTEM.

TO THE EDITOR OF SCIENCE: I wish to add a hearty amen to what Professor Webster has said in SCIENCE, for June 3, 1904, in reference to the timidity of a few (a very few, I think and hope) of the friends of the metric system of weights and measures. As it is now more than a third of a century since I joined in an active dissemination of information regarding this system and an earnest advocacy of metrological reform through its adoption, and as I have enjoyed many opportunities for knowing the attitude of the people on this question, in various parts of the United States and at various times during these years, I hope I shall not be accused of extravagant or careless statement when I say that there are many more advocates of the adoption of the metric system in the country to-day than ever before, and that the opposition to it is not increasing, but everywhere steadily, and in some regions rapidly, decreasing. I will not undertake an elaborate proof of this statement, for it is quite unnecessary to do so and it will be generally admitted, I think, among those who have thoroughly investigated the subject. This sentiment is especially reflected in the general unanimity of opinion among representatives in congress, coming from all parts of the country and particularly in the *aggressive and well-organized opposition* that has developed within a few years. Indeed, nothing has been more encouraging to the friends of metrological reform than the rather sudden appearance of this not inconsiderable and always respectable mass of conservatism in battle array, for if the metric system can not stand under the most searching criticism or relentless opposition, then it ought to fall. Although it may be truthfully declared that there is not an argument against the adoption of the system that was not met and refuted more than twenty years ago, the recent publication of papers, pamphlets, letters, etc., in which the old objections have been restated and the old arguments bolstered up, has served a useful purpose in bringing their weakness to the attention of a larger audience. The people will understand after a while, and they are beginning to understand now, that the commercial interests of the country, both domestic and foreign, are bearing an enormous and wholly unnecessary load on account of the selfishness of a really small group of men engaged in a special industry, whose opposition is generally not due to any objection to the new system itself, but only to the alleged cost of substituting it for the old. In the meantime our great competitors in the world's activities have learned their lesson, most of them long ago; the only one still holding fast (with us) to this relic of barbarism, a thoroughly unscientific system of weights and measures, is just on the point of letting go. That we must follow in the near future is certain and all discussion, even including unreasoning opposition, must hasten the day.

It is of the greatest importance, however, that there should be no temporizing or 'arbitration' with the opposition to this, one of the most, if not the most, important economic reform yet brought to the attention of our people. It would be infinitely better to wait a few years longer (in which the inevitable operation of natural causes will greatly diminish the number of opponents) than to yield to any suggestion looking to the retention of the old units of lengths and mass or to *any* modification, in any essential feature, of the system as it is now in almost universal use among civilized nations.

There is a great necessity for a reform in the method of *using* weights and measures in ordinary commercial transactions, to which the metric system lends itself, and which will be one of the most important incidental advantages of its adoption. I refer to the more general use of weight instead of capacity measures. Practically, nearly every transaction involving quantity of matter can be better managed by weighing than by measuring; better, because nearly always far more accurately, and generally more conveniently. In the part of the world in which I am writing, the kilogram is practically the only unit used in dealing with all commodities, excepting, of course, textile fabrics and the like. There is nothing taking the place of the bar-

rel, bushel, peck, quart, etc., for apples, peaches, cherries, strawberries and berries of all kinds, potatoes, asparagus and, as far as I have been able to note, all vegetables and practically all fruits, except oranges (sold by count) are weighed out in kilos or grams. The man with the push-cart who peddles these things in the street always weighs them, and even the basket-man, whose entire stock in trade may often be bought for less than ten cents, carries his steelyard-like balance thrown over his shoulder. Indeed, I have never seen, as I have gone about the streets of Italian cities, in any of the many vegetable shops or other shops where food material is sold at retail, any other method of measuring quantity, barring a very few cases in which counting is used, as in dealing with eggs or oranges; even liquids are generally sold by weight and when a liter of anything is asked for it is usually weighed. This morning I happened to visit one of the largest grocery and food-supply houses in Florence. Among an almost infinite variety of products sold here there may be mentioned, peas, beans (dry), hominy, meal of various kinds, etc., alcohol, benzine, petroleum and very many other articles, all of which in the United States would ordinarily be sold by the quart, peck, gallon or other capacity measure.

The manager told me that all of these, even including wine in which he deals largely, are sold only by weight; that he had once had a single liter measure in his store which he had used for a time in measuring petroleum, but that he now has no capacity measure whatever in his entire establishment. In some shops petroleum is sold by volume, but in many others always by weight.

The use of weight instead of volume is a great benefit to the purchaser and is equally advantageous to the honest dealer, but it is only possible in a system in which the translation from mass to volume is quickly and easily made. Weighing can always be done with a much higher degree of accuracy than is possible with volume measuring, allowing the same time and care.

Cheating by means of false measures, or by correct measures loosely filled or 'topped,' is very common, and inspectors find it difficult to deal with. False balances and weights are much more easily detected. Then there is that large collection of most uncertain measures of extensive use but without the least legal standing, including the box, basket, crate, package, 'bunch' and the like, by means of which peaches, berries, etc., are retailed to a confiding public, the capacity of box or basket depending entirely on the disposition of the dealer and the scarcity of the commodity. It is worth a good deal to be protected from this sort of petty robbery.

T. C. M.

Florence, Italy,
June 17, 1904.

HONORARY DEGREES IN ENGINEERING.

To the Editor of Science: For several years our technical press has called attention after each commencement season to the disproportionately small number of engineers among those whose attainments receive the sanction of academic approval in the form of honorary degrees. The *Street Railway Journal*, the exponent in America of the most progressive branch of electrical engineering, calls attention to this unsatisfactory state of affairs in its issue of July 16.

The value of education is to a very great extent realized in service, and there is no better indication of true appreciation of the ends of education on the part of our institutions which are devoted mainly to the beginnings of it than the conferring of honorary degrees wisely.

Our universities, to the extent that they stand for research, have an end in themselves, and academic honors are promptly bestowed upon those who contribute to the advancement of learning. Our colleges and technical schools, on the other hand, are devoted almost exclusively to teaching and they have no end in themselves. No college teacher can draw much inspiration from the meager attainments of his untried graduates. The fruit of his labor is extra-academic, and the effectiveness of his labor depends upon his being sufficiently a man of the world to know these fruits and to draw his inspiration from them. If the

granting of honorary degrees by our colleges to men outside of academic life has any reason to be, and surely it has, it is because such academic recognition is an expression of appreciation on the part of the personnel of the college of the things in which alone the results of their labors take on the garb of reality. As an expression of this kind of appreciation the function of the college in the granting of honorary degrees contributes vastly more to the credit of the college when wisely performed than to the sum of honor that rests upon those who do the world's work and carry its heavy dignities.

Quite the most absurd notion respecting this conferring of honorary degrees is the more or less confused idea of many a circumscribed academician that it is the making rather than the marking of a distinction; and growing out of this pitifully foolish idea is the exaggerated dread of the prostitution of this really vital function of our academic institutions.

Let one read the words of President Van Hise (SCIENCE, July 15, p. 92) and consider whether anything could be more stimulating to a group of young graduates at a time when everything conspires to awake in them the most serious emotions. If the granting of honorary degrees is not a vital function it may easily be made such, and as such its greatest, perhaps its only benefit would accrue to the institution performing it.

It is a general impression, and perhaps it is true, that the number of engineers is disproportionately small among those who at each commencement season receive honorary degrees. If it is true, it is to be hoped that some of our larger schools of engineering may consider it. In any case it would be appropriate for our Society for the Promotion of Engineering Education to look into the matter.

W.

'PTERIDOSPERMAPHYTA.'

TO THE EDITOR OF SCIENCE: In proposing the name 'Pteridospermaphyta' (SCIENCE for July 1, 1904, p. 25), Professor Lester F. Ward does not seem to have noticed that Oliver and Scott have published 'Pteridospermæ' as the name of the group, in a paper presented to the Royal Society, January 21, 1904, entitled 'On the Structure of the Paleozoic Seed *Lagenostoma Lomaxi*, with a Statement of the Evidence upon which it is Referred to *Lyginodendron*.' Abstract preprints of this paper were distributed early in the year, were published prominently in *Nature*, 69: 334, February 4, 1904, and reviewed in the *Botanical Gazette*, 37: 237, March, 1904. The name was further established by Oliver in a paper entitled 'A New Pteridosperm,' published in the *New Phytologist*, 4: 32, January, 1904, and also reviewed in the *Botanical Gazette* (*l. c.*).

It was proposed by Oliver and Scott to establish 'a distinct class,' under the name Pteridospermæ, to 'embrace those paleozoic plants with the habit and much of the internal organization of ferns, which were reproduced by means of seeds.' JOHN M. COULTER.

SPECIAL ARTICLES.

AUTOTOMY, REGENERATION AND NATURAL SELECTION.

HISTORY warns us that it is the customary fate of new truths to begin as heresies and to end as superstitions; and as matters now stand it is hardly rash to anticipate that in another twenty years the new generation, educated under the influences of the present day, will be in danger of accepting the main doctrines of the 'Origin of Species' with as little reflection and it may be with as little justification as so many of our contemporaries twenty years ago rejected them. —Huxley, 1880.

Huxley's prophecy has not been quite fulfilled, for the fate of natural selection as a scientific account of organic adaptations still depends on the testimony of witnesses. Nevertheless, the warning of 1880 is a wholesome stimulant to take before considering some recent objections that selection accounts neither for the process of self-mutilation, so common among the crustacea, nor for the ability of living things in general to repair injuries by the restoration of lost parts.

These two processes, autotomy and regeneration, have been studied by those who consider

them evidence in favor of selection, as well as by those to whom Darwinian explanations seem absurd. In this latter group is Professor T. H. Morgan, whose books, 'Regeneration' and 'Evolution and Adaptation,'* assert the inadequacy of selection. As the work summarized in the first volume has inspired the point of view from which the second one was written, a careful criticism of the former is a test of the soundness of the latter. Such criticism is difficult, not only from the nature of the subject, but especially because of a paradoxical frame of mind due to my agreement with Professor Morgan's main contention without being able to accept his own reasons for it.

Autotomy.—Professor Morgan regards the process of autotomy as a fatal stumbling block for the theory of natural selection. Thus on page 155 of 'Regeneration' we read:

> Even if it were granted that the theory of natural selection is correct, it does not follow that all useful processes have arisen under its guidance. We may, therefore, leave the general question aside, and inquire whether the process of autotomy could have arisen through natural selection (admitting that there is such a process for the sake of the present argument), or whether autotomy must be due to something else.

If we assume that the leg of some individual cray fishes or crabs, for example, broke off, when injured, more easily at one place than at another, and that regeneration took place as well, or even better, from this region than from any other, and if we further assume that those animals in which this happened would have had a better chance of survival than their fellows, then it might seem to follow that in time there would be more of this kind of animal that survived. But even these assumptions are not enough, for we must also assume that this particular variation was more likely to occur in the descendants of those that had it best developed, and that amongst those forms that survived, some had the same mechanism developed in a still higher degree, and, the process of selection again taking place, a further advance would be made in the direction of autotomy. This, I think, is a fair, although brief, statement of the conventional argument as to how the process of natural selection takes place. But let us look further and see if the results could be really carried out in the way imagined, shutting our eyes for the moment to the number of suppositions that it is necessary to make in order that the change may occur. It will not be difficult, I believe, to show that even on these assumptions the result could not be reached. In the first place, the crabs that are not injured in each generation are left out of account, and amongst these there will be some, it is true, that have the particular variation as well developed as the best amongst those that were injured, and others that have the average condition, but there will be still others that have the possibilities less highly developed, and the two latter classes will be, on the hypothesis, more numerous than those in the first class. The uninjured crabs will also have an advantage, so far as breeding and resisting the attacks of their enemies are concerned, as compared with those that have been injured, and in consequence they, rather than the injured one, will be more likely to leave descendants. Even if some of those that have been injured, and have thrown off the leg at the most advantageous place, should interbreed with the uninjured crabs, still nothing, or very little, can be gained, because, on Darwinian principles, intercrossing of this sort will soon bring back the extreme variations to the average.

The process of natural selection could at best only bring about the result provided all crabs in each generation lose one or more of their legs, and amongst these only the ones survive that break off the leg at the most advantageous place; but no such wholesale injury takes place, as direct observation has shown. At any one time only a small percentage, about ten per cent., have regenerating legs, and as the time required completely to regenerate a leg, even in the summer, is quite long, this percentage must give an approximate idea of the extent of exposure to injury. It is strange that those who assert offhand that, because autotomy is a useful process, therefore it must have been acquired by natural selection, have not taken the pains to work out how this could have come about. Had they done so, I can not but believe they would have seen how great the difficulties are that stand in the way.

A further difficulty is met when we find that each leg of the crab has the same mechanism. If we reject as preposterous the idea that natural selection has developed in each leg the same structure, then we must suppose that a crab varies in the same direction in all its legs at the same time; and if this is true it is obvious that the prin-

* 'Regeneration,' by Thomas Hunt Morgan, The Macmillan Company, New York, 1901. 'Evolution and Adaptation,' by Thomas Hunt Morgan, The Macmillan Company, New York, 1903.

ciple of variation must be a far more important factor in the result than the picking out of the most extreme variations. The same laws that determine that one individual varies in a useful direction farther than do other individuals may, after all, account for the entire series of changes. If it be replied that natural selection does not take into account the causes of the differences of individual variation, this is to admit that it avowedly leaves out of account the very principles that may in themselves, and without the aid of any such supposed process as natural selection, bring about the result. The Lamarckian principle of use and disuse does not give an explanation of autotomy, since the region of the breaking-joint is not the weakest region of the leg, or the place at which the leg would be most likely to be injured.

We can not assume autotomy to be a fundamental character of living things, since it occurs only under special conditions, and in special regions of the body. While it might be possible to trace the autotomy of the legs of the crustacea, myriapods and insects, to a common ancestral form, yet this is extremely improbable, because the process takes place in only a relatively few forms in each group. The autotomy of the wings of white ants that takes place along a preexisting breaking line must certainly have been independently acquired in this group. The breaking off of the end of the foot in the snail helicarion is also a special acquirement within the group of mollusca.

Bordage has suggested that the development of the breaking joint at the base of the leg of phasmids has been acquired in connection with the process of moulting. He has observed that during this period the leg can not, in some cases, be successfully withdrawn through the small basal region; and hence, if it could not break off, the animal would remain anchored to the old exoskeleton. It escapes at the expense of losing its leg. The animal, having acquired the means of breaking off its leg under these conditions, might also make use of the same mechanism when the leg is held or injured, and thereby escape its enemy. The fact that the crayfish has a breaking joint only for the large first pair of legs would seem to be in favor of this interpretation, but the crab has the same mechanism for the slender walking legs that one would suppose could be easily withdrawn from the old covering. It should also be remembered that we do not know whether the breaking joint at the base of the leg of the crab and of the crayfish would act at the time when the leg is being withdrawn from the old exoskeleton, unless the leg were first injured outside of the joint.

Our analysis leads to the conclusion that we can neither account for the phenomenon of autotomy as due to internal causes alone in the sense of its being a general property of protoplasm, nor to an external cause, in the sense of a reaction to injury or loss from accident. There would seem then only one possibility left, namely, that it is a result of both together, or in other words, a process that the animal has acquired in connection with the conditions under which it lives, or in other words, an adaptive response of the organism to its conditions of life.

We are not, however, able at present to push these questions farther, for, however probable it may seem that animals and plants may acquire characteristics useful to them in their special conditions of life, and yet not of sufficient importance to be decisive in a life-and-death struggle, still we can not, at present, state how this could have taken place in the course of evolution. For, however plausible it may appear that the useful structure has been built up through an interaction between the organism and its environment, we can not afford to leave out of sight another possibility, viz., that the structure or action may have appeared independently of the environment, but after it appeared the organism adopted a new environment to which its new characters made it better suited. If the latter alternative is true, we should look in vain if we tried to find out how the interaction of the environment brought about the adaptation. The relation would not be a causal one, in a physical sense, but the outcome of a different sort of a relation, viz., the restriction of the organism to the environment in which it can remain in existence and leave descendants.

For one whose life consists of a struggle for existence, it is difficult to appreciate the delicate humor with which Professor Morgan 'admits' natural selection for the sake of argument; it is more difficult for him to understand the objection that variations are not fit until they have been fitted into some part of the external world; but it is harder yet for him to see that 'the restriction of the organism to the environment in which it can remain in existence and leave descendants' differs from 'natural selection' except in the number of words used to express the same idea. These minor points, however, have little bearing on the evidence from autotomy. To appreciate

the value of this evidence it is necessary first of all to disentangle the fact that the crab has a mechanism to facilitate self-mutilation, from the fact that the mutilated parts are restored. This distinction is not only easy to make, since the legs regenerate at other levels, but it is also very important. One who recognizes the independence of these two facts does not hold the foolish opinions attributed to him any more than he accounts for his ability to mend a broken clavicle by referring to gifted ancestors whose success in life depended on the frequency and completeness with which they broke their collar bones.

The separation between the fact that there is a mechanism for throwing off legs, and the fact that the legs are regenerated from the point at which they are thrown off, leaves for consideration only the basis of the belief that the breaking joint is not of use to the species. The evidence for this belief is as follows: 'At any one time only a small percentage, about ten per cent., have regenerating legs, and as the time required completely to regenerate a leg even in the summer is quite long, this percentage must give an approximate idea of the extent of exposure to injury.' Thus the extent to which the mechanism is used is held to be too slight to account for its existence in the other ninety per cent. of the crabs. However, as this determination is only for 'any one time,' it falls into a class of statistical evidence which shows, according to Professor Brooks, that 'our subject matter lies midway between those exact sciences in which we are told that figures can not lie * * * and those social and political sciences which show us continually how easily one may lie with figures.'*

Granted that at any given time ten per cent. of crabs show that they have made use of the mechanism for throwing off their legs, this percentage gives no idea of the extent to which each crab uses the breaking joints during its entire life. How long a crab lives is not definitely known, but from analogy and indirect evidence five years is within the limit of life for some species. 'As the time required completely to regenerate a leg even in the summer is quite long,' it follows that in six months an appendage may regenerate completely.

Five years represent ten periods of six months. If in each period we were to count the ten injured individuals of a given hundred, then at the end of the full term we should have counted one hundred injuries, which, according to the doctrine of chance, would have been distributed among sixty-five individuals. Thus in five years, two out of three crabs would have been injured one or more times.

Regeneration.—Professor Morgan's book is one continuous protest that natural selection does not account for the ability of organisms to regenerate lost parts. Thus on the last page of 'Regeneration' he summarizes his convictions in the following words: "It seems highly probable that the regenerative process is one of the fundamental attributes of living things, and that we can find no explanation of it as the outcome of the selective agency of the environment. The phenomena of regeneration appear to belong to the general category of growth phenomena and as such are characteristic of organisms."

This demonstration, 'that the regenerative process is one of the fundamental attributes of living things,' seems valid; but to those who believe that natural selection is a law of nature, proof that the regenerative process is fundamental is likewise proof that natural selection has no bearing on this process. Natural selection is not an explanation of things ultimate any more than the law of falling bodies is an explanation of the fundamental characteristics of matter. No one holds that Newton's laws are invalidated because they do not explain the ultimate attributes of materials that fall, or of the space in which they fall, or why they fall in the order that we observe, because every one knows, or has known, that Newton's laws are merely records of events. Natural selection is the series of events which occurs in nature as the outcome of individual differences, the high rate of increase and the environment of living things. The charge, therefore, that this

* W. K. Brooks, 'The Intellectual Conditions for Embryological Science,' SCIENCE, XV., p. 488.

series of events does not explain one of the fundamental attributes of living matter is irrelevant.

An explanation of this curious misapprehension, as well as a remedy for it, may be found in the definition of regeneration as either the homomorphic or the heteromorphic replacement of lost parts, or the development of whole as well as imperfect organisms from pieces of adults, embryos or eggs. This definition leaves out of account a large class of true regenerative phenomena. Unless the term 'regeneration' has become a technical one, intended to convey only half of its legitimate sense, every restorative process should be included under it. It seems to me that if all anabolic processes were included in our common acceptance of the term, we should neither forget that the ability to regenerate is a fundamental attribute of living things, nor try to account for it by natural selection.

O. C. GLASER.

JOHNS HOPKINS UNIVERSITY.

CURRENT NOTES ON METEOROLOGY.

JAMES GLAISHER.

IN the *Quarterly Journal of the Royal Meteorological Society,* Vol. XXX., 1904, pp. 1–27, Mr. William Marriott, assistant secretary of the society, has a paper on the meteorological work of the late James Glaisher, F.R.S., whose death, in February, 1903, was duly noted in these columns. Glaisher was the founder of the Royal Meteorological Society in 1850. He had, in 1840, been appointed superintendent of the magnetic and meteorological department of the Royal Observatory, Greenwich. He soon became interested in and conversant with all kinds of meteorological investigations, and through his instrumentality numerous meteorological stations were equipped in various parts of the country. From 1847 to March, 1902, he supplied quarterly the results from those stations to the registrar general. He prepared various tables of corrections for the use of the observers, the principal of which were his 'Hygrometrical Tables,' which have passed through nine editions. He was a juror of the Great Exhibition of 1851, and as such he caused a great stimulus to be given to the manufacture of reliable meteorological instruments. Glaisher was best known to the public by the twenty-eight balloon ascents which he made for scientific purposes in the years 1862–1866, on behalf of a committee of the British Association. A bibliography of the writings of Glaisher is appended, and the statement is made that the instruments which he used during his balloon ascents have been given to the Royal Meteorological Society by his son. The last paper by James Glaisher appeared in the *Quarterly Statement of the Palestine Exploration Fund,* 1902, and is entitled 'Rainfall at Jerusalem in the Forty-one Years 1861–1901.'

THE DUST-FALL OF FEBRUARY, 1903.

'THE Great Dust-Fall of February, 1903, and its Origin' is discussed by H. R. Mill, R. G. K. Lempfert and J. S. Flett in the *Quarterly Journal of the Royal Meteorological Society,* Vol. XXX., 1904, pp. 57–88. The dust fell over nearly all parts of England and Wales to the south of a line drawn from Anglesey through Wrexham and Northampton to Ipswich, except in parts of northern Cornwall, Somerset, Wilts and Mid-Wales. At many stations to the north of this line the dust-fall did not attract the attention of observers, but is believed to have taken place on account of the distinct marks of yellow dust detected on the sunshine cards sent in to the Meteorological Office. The dust usually attracted attention either in the form of a dense yellow haze, like a London fog, or as a reddish-yellow powder, lying thickly on trees or roofs, or adhering to windows. There is reason to believe that the air which reached the southern half of England on February 22 started from the northwest coast of Africa on the nineteenth. Dr. Flett, who examined the dust microscopically, reports that the bulk of each specimen of dust presented to him for examination consisted of comparatively coarse particles of mineral and organic origin derived from the locality where it was collected. In addition to the coarser particles, all the samples contained a very fine-grained reddish clay, the particles of which were too minute

to be satisfactorily determined mineralogically. This clay was derived from some source beyond the British Isles, but it was not distinctive enough to afford much evidence as to its place of origin.

TEMPERATURE OF THE LOWER AIR.

In the *Meteorologische Zeitschrift,* XXI., 1904, pp. 49–62, Woeikof discusses the temperature of the lower air and the relation of this temperature to the temperature of the earth's surface. The vertical distribution of temperature in the ground is considered under two principal heads, 'I., The Sun, or Diurnal, Control,' and 'II., The Radiation, or Nocturnal, Control.' There are four types. The first (A) is characterized by a mean annual surface temperature higher than that further down. Where observations are available, and where this type is well developed, the surface is warmer than the air. In type B the temperature increases regularly from the surface downward; this may be called the snow type, and prevails where the ground is snow-covered for the whole year, or for at least three quarters of the year. In type C the temperatures of air and surface are uniform, and this occurs in moist, rainy districts of the middle and higher middle latitudes where there is no regular snow cover. Type D has a considerably higher mean annual temperature in the ground than in the air, and is, therefore, the rule in tropical and subtropical climates.

NEW MOUNTAIN OBSERVATORIES IN LAPLAND.

Nature of June 16, 1904, notes the successful establishment, by Dr. Hamberg, of Stockholm, of meteorographs at two high-level stations in Swedish Lapland. One of these, on the Portitjokko, at 1850 meters, has been working satisfactorily since July, 1902, with the exception of occasional interruptions of the anemometer owing to hoar frost. The second is on the Sähkok, at about 1,080 meters. Each set of apparatus weighs 1,000 kilograms. The clocks are to run for a year, the 'weights' being 300 kilograms each. Instead of using ink, which is unsatisfactory, punctures are made every twenty minutes in the papers covering the drums of the instruments.

NOTES.

Hann, in his 'Handbuch der Klimatologie,' second edition, Vol. III., pp. 249–250, gives a few notes on the climate of Manchuria, based chiefly on an article by Rev. John Ross in the *Scottish Geographical Magazine* for May, 1895. In *Ciel et Terre* for June 1, 1904, a summary of these same observations is given.

In the *Scottish Geographical Magazine* for June, Victor Dingelstedt describes the Crimean and Caucasian coasts of the Black Sea, finds them analogous in many ways to the Genoese and French coasts of the Mediterranean, and states the belief that these districts are about to be developed as a health resort for those who stand in need of a sojourn in mild climates.

The importance of the cyclonic control of our temperatures in the eastern United States in winter, and the dominance of the diurnal (*i. e.,* direct solar) control in summer, is brought out in a paper on 'The Temperature Element of the Climate of Binghamton, N. Y.,' in the *Monthly Weather Review,* XXXII., 1904, p. 78. The discussion of climate with due emphasis on the weather controls which bring about different types or extremes of temperature, pressure, wind velocity, etc., is a matter which deserves much more attention than it has yet received.

In a paper on 'Certain Relationships between the Diurnal Curves of Barometric Pressure and Vapor Tension at Kenilworth (Kimberley), South Africa' (*Quart. Journ. Roy. Met. Soc.,* XXX., 1904, 41–53), J. R. Sutton refers to the views of a number of leading meteorologists on the part played by vapor tension as a component of barometric pressure, and brings forward a series of observations at Kimberley designed to throw light on the still unsolved problem of the diurnal barometric wave.

Meteorological observations from the Arctic and the Antarctic are accumulating with remarkable rapidity. One of the latest additions to the collection from the Arctic is the series of four years' observations taken during the second voyage of the *Fram,* under Captain Sverdrup (Appendix IV., in 'New Land:

Four Years in the Arctic Regions,' by Otto Sverdrup; translated into English, 2 vols., London, 1904).

R. DEC. WARD.
HARVARD UNIVERSITY.

NOTES ON ENTOMOLOGY.

As if we did not have enough names for the orders of insects, Mr. A. E. Shipley generously gives us seven more.* These are presented for the sake of having the names of all the orders terminate in '-ptera.' The new names are Apontoptera for Collembola, Lipoptera for Mallophaga, Ellipoptera for Anoplura, Psocoptera for Psocidæ, Embioptera for Embiidæ, Ephemeroptera for Ephemeridæ, and Paraneuroptera for Odonata. He appears to have overlooked the fact that the mayflies already had two '-ptera' names in Plectoptera and Anisoptera (Steph.). His new term, Ephemeroptera, has already been used in the same sense some fourteen years ago. If the terms Aptera and Neuroptera, which in the past covered all sorts of creatures, can now be applied to one order, why can not Archiptera or Pseudoneuroptera be restricted to the Odonata, and Synaptera to the Collembola; these latter names have had a much more exclusive membership. Nothing is done by Mr. Shipley with the Hemiptera, although it is nearly as heterogeneous as the Neuroptera of Linné. However, there are '-ptera' names (from 1835) for the four principal groups.

Now if the '-oura,' '-gnatha' and '-poda' partizans extend their nomenclature to the various orders, the requirements of science may be met.

A recent book by Georges Guénaux is a useful compendium of European economic entomology.† It forms a volume, in G. Wery's 'Encyclopédie Agricole.' About 100 pages are devoted to worms, the remainder to entomology. One chapter is devoted to structure and classification, then follow chapters on insects injurious to all crops, to cereals, to beets and clovers, to garden crops, to fruit trees, to the vine, to forest trees, to horticulture, in houses, to domestic animals and man, beneficial insects, destruction of injurious species, and myriapods and arachnids. The economic treatment is given with each injurious species. A great many of their remedial measures have been but little tried in this country.

Professor C. B. Davenport has given us an instructive account of the habits of certain Poduridæ affecting the sea-beach.* Three species inhabit the beach between high- and low-water marks. At high tide they are in the sand to a depth of six or more inches; as the tide falls they come to the surface and sport about on the pebbles. He interprets their almost continual jumping movements as useful to increase respiration, and shows that they leap into the wind, and not before it. When the tide rises they bury themselves in the sand, and Professor Davenport thinks that they feed, while thus submerged, upon particles of organic matter in the sand.

The peculiar wavy motion of centipedes has long excited even poetic minds to the wonder of how they managed to utilize all their legs in such a harmonious way. E. Ray Lankester has investigated the matter and arrives at several interesting results.† The legs move in groups or waves. Each wave includes a certain definite number of legs, apparently constant for each species. In the forms studied each wave contained from eight (in *Peripatus*) to sixteen members (in the millipede). The number of waves in a species depends upon the number of legs and the number of legs in the wave. He shows that in millipedes the waves of each side are opposite or synchronous, that is each leg of a pair moves just as its fellow. While in the centipedes each leg of a pair is in an opposite position from its fellow, so that the waves are symmetrically alternate. In the millipedes the body does not aid in locomotion, but in the centipedes the motion is partially due to the undulations or wriggling of the body. This fact indicates the more complex nature of the centipede.

* 'The orders of insects,' *Zool. Anz.*, XXVII., 259–262.

† 'Entomologie et Parasitologie Agricole,' Paris, 1904, pp. 580, figs. 390.

* 'The collembola of Cold Spring Beach, with Special Reference to the Movements of the Poduridæ,' Cold Spring Harbor Monographs, II., pp. 30, 1 pl., 1903.

† 'On the Movements of the Parapodia of *Peripatus*, Millipedes and Centipedes,' *Quart. Journ. Micr. Science*, March, 1904, pp. 577–582, 1 plate.

Professor Aug. Lameere, the eminent Belgian coleopterist, who has for some time been engaged in the praiseworthy work of revising the Prionides of the world, has issued a considerable portion of his monograph.* Abandoning older customs he has examined all available material in the European museums, and is thus able to furnish much synonymic matter. Each species is fully described, sometimes with ethological notes, and there are tables to the species of each genus. After each genus he has a chapter on the relationships and geographic distribution of the species.

Mr. J. E. Guthrie has prepared an account of the Collembola of Minnesota.† Fifty-eight species are listed. There are synoptic tables to the genera and species. Under each species is placed the original description, together with notes by the author; full synonymy is given, and there is a bibliography of works consulted. The plates illustrate the essential details of structure. It will be a very useful book, especially for one beginning the study of this neglected order of tiny insects.

The fourth volume of Tutt's exhaustive work‡ on the British Lepidoptera finishes the Sphingidæ. The thoroughness with which the multitude of details has been arranged in this work will never cease to excite wonder. Two species occupy together over 130 pages. With this volume there is published a synopsis of the contents and general index to Volumes I. to IV. In the preface Mr. Tutt gives an excellent criticism of the rules of nomenclature used by Rothschild and Jordan in their recent revision of the Sphingidæ. It may be noted that he uses *Sesia* in place of *Macroglossum*.

The *Annales du Musée du Congo*, which for some time has been published by the Belgian authorities, has commenced to treat of the insect fauna of the Congo region. Two portions have been issued; one on the group Prionides of the longicorn beetles, is by Professor A. Lameere; the other on the family Scutelleridæ of the Heteroptera is by Dr. H. Schouteden. The work appears in fascicles of folio size, and, if continued, will soon be a rival of the *Biologia Centrali Americana*. The plates appear to be fully equal to the best in that work.

E. Lynch Arribalzaga has described a new species of bird-grasshopper,* *Schistocerca peruviana*, which does considerable damage to cultivated crops in parts of Peru. It is closely related to several of the other destructive species, such as *S. peregrina* and *S. paranensis*, and more intimately to the American bird-grasshopper of our eastern states, *S. americana*. Nothing has been done in the way of remedial treatment.

In the same journal,† J. Brethes has given a revision of the South American Vespidæ, and of the Eumenidæ of the La Plata basin. Synoptic tables are given, and there are descriptions of many new species. E. L. Homberg in the same journal (pp. 377–512) describes a great number of new bees and fossorial hymenoptera, principally from Argentine.

NATHAN BANKS.

* 'Revision des Prionides, Macrotomines,' *Mém. Soc. Ent. Belg.*, XI., pp. 216, 1904.

† 'The Collembola of Minnesota,' Geol. and Nat. Hist. Surv. of Minn., Zool. Series, IV., Minneapolis, 1903, pp. 103, 16 plates.

‡ 'A Natural History of the British Lepidoptera,' Vol. IV., London, April, 1904, pp. 535, 3 pls., by J. W. Tutt.

* 'La Langosta Voladora del Peru,' *Anales Mus. Nac. Buenos Aires* (3), Vol. II., pp. 1–5, 1904.

† *Ibid.*, pp. 15–39 and 231–320.

THE INTERNATIONAL ELECTRICAL CONGRESS.

WE are informed that under the auspices of the Louisiana Purchase Exposition, an International Electrical Congress will be held in St. Louis during the week of September 12–17. The congress will be divided into two parts, namely:

(1) A Chamber of Government Delegates appointed by the various governments of the world, invitations to which were issued at the beginning of the year from the United States government. The transactions of the Chamber of Delegates will relate to matters affecting international questions of electrical units, standards, and the like.

(2) The Congress at large, divided into eight section, as follows:

General Theory: Section A, Mathematical, Experimental.

Applications: Section B, General Applications, Section C, Electrochemistry; Section D, Electric Power Transmission; Section E, Electric Light and Distribution; Section F, Electric Transportation; Section G, Electric Communication, Section H, Electrotherapeutics.

The president of the committee of organization is Professor Elihu Thomson, of Lynn, Mass. The vice-presidents are B. J. Arnold, Professor H. S. Carhart, Professor W. E. Goldsborough, C. F. Scott and Dr. S. W. Stratton.

Three hundred and forty-three official invitations were issued some months ago to well-known workers in electricity, inviting papers for the congress. 168 of these invitations were issued to persons residing in countries outside of North America. As a result of these invitations, 105 American and 59 foreign specially prepared papers are promised to the congress. Up to June 30, 1,787 adhesions to the congress had been received, of which about 1,300 have paid their subscriptions of $5.00 each. Of these, 291 are from countries outside of North America. The following societies will cooperate with the congress at St. Louis, by holding simultaneous conventions and joint sessions:

The American Institute of Electrical Engineers.
The American Electrochemical Society.
The American Physical Society.
The American Electrotherapeutic Association.
The Association of Municipal Electricians.

The following societies will cooperate with the congress by appointing delegates:

The National Electric Light Association.
The Association of Edison Illuminating Companies.
The Société Internationale des Electriciens.
The Schweizerscher Electrotechnischer Verein.

It is expected that various other European societies will also cooperate. Fourteen thousand six hundred invitations have been issued to persons interested in electricity all over the world, inviting them to join the congress. It is expected that the 'Transactions' of the congress will attain two or three large volumes. Persons interested in electricity and who desire to join the congress should apply to the general secretary, Dr. A. E. Kennelly, Harvard University, Cambridge, Mass. Each member of the congress is entitled to receive one set of the 'Transactions.' It is intended to issue the 'Transactions' of the congress, when printed, to libraries and non-members for $10.00 per set.

AMERICAN AND GERMAN UNIVERSITIES.

IT is interesting to note that of the 37,692 students enrolled in the German universities for the term now drawing to a close, 3,093 were foreigners, of whom 986 were Russians. Female students to the number of 1,314 were enrolled for the term.

These figures do not include such students as are merely guests (hospitants), of whom there are always quite a number. These enjoy all the privileges of the regular students, but they can not be graduated. If these be added to the others, it is safe to say that fully 10 per cent. of those attending German universities are foreigners. Almost one thousand Russians, or nearly one third of the foreign element, were matriculated last winter. Next come the Austrians and Hungarians, numbering 601, or about 20 per cent. Switzerland furnished 322 regular students, and there were 324 Americans enjoying the same opportunities.

The number of foreign students, especially of those coming from Russia, has steadily grown, but a careful study of the attendance at the German universities seems to show that Americans have not been adding to this increase. Thus, if we look over the reports of the winter half-year of 1899–1900, we find that the total attendance at German universities during that period was 32,834 regular students, of whom 2,369, or about 7 per cent., were foreigners; and that 607 of these were Russians, 455 Austrians, 265 Swiss, and 317 Americans. Thus there were only seven more Americans enrolled last winter than there were four years ago.

During the nineteenth century German universities led the world in erudition and scien-

tific investigation, and their great professors attracted many students from all parts of the world in quest of higher education. But times are altered. Having myself been engaged in educational work as an American college professor for a good part of my manhood, I have naturally taken considerable interest in the life and work at the various institutions of learning in this country, and it is my impression that the facilities for higher education are improving in the United States much more rapidly than in Germany. Despite all our imperfections one can not but admire the great upward strides which the American system of education, from the humble district school up, has been making during the last few decades.

American educational institutions are the best equipped in the world. I know but one German university that can claim to be up to the times in this regard, and it stands third in the list of attendance. There is a steady progress all along the line of public instruction in the United States, and particularly in our higher class of universities.

The regular reports of German universities will continue to show the attendance of American students. Though their number may not increase materially, still they come. And it is well that they should, particularly those that have in view special studies and investigations in certain lines; for Germany is preeminently the land of specialists, and it must be admitted that German devotion to special work has added immensely to the sum of knowledge. Besides, a year or two spent abroad can not but prove to be a great blessing to the average American student, not because he needs it to prepare him for his life's work, but because travel and sojourn in this and other countries are in themselves a liberal education, and tend to broaden the mind, widen the horizon, remove petty prejudices, and supply an independent judgment of men and matters. A few semesters at a German university, bringing a young man in touch with the ideas and methods of the great scholars and scientists of this country, as well as with the spirit of the German student's life, is an advantage generally appreciated all through life. But all this is rather a luxury than a necessity. No American need any longer come to this or go to any other country for higher education. In my judgment the United States offers to-day facilities for collegiate, academical and postgraduate studies equal in quantity and quality to those offered by any country in the Old World.

HENRY W. DIEDERICH,
Consul.

BREMEN, GERMANY,
June 10, 1904.

SCIENTIFIC NOTES AND NEWS.

THE daily papers announce, we trust correctly, that Dr. Harry Tevis will establish in San Francisco an aquarium in honor of his father, the late Lloyd Tevis, which will be the finest institution of the kind in the world, the cost being $3,000,000 to $4,000,000. The aquarium will, it is said, be built in Golden Gate Park. Mr. John Galen Howard, supervising architect of the University of California, is preparing the plans.

SIR JOSEPH DALTON HOOKER, the great British botanist, celebrated on June 30 his eighty-seventh birthday.

DR. KUNO FISCHER, professor of philosophy at Heidelberg, celebrated on June 23 his eightieth birthday.

DR. ROBERT KOCH has been made honorary professor of the University of Berlin as well as a member of the Academy of Sciences in succession to Virchow. There are only two other similar positions at Berlin, the one held by Professor Auwers, the astronomer, the other by Professor Van't Hoff, the chemist.

THE Paris Academy of Sciences has elected as corresponding members M. Eugène Tisserand in the section of agriculture and Dr. E. Metschnikoff in the section of anatomy and zoology.

DR. PIETRO BLASERNA, professor of physics at Rome, has been elected president of the Accademia dei Lincei.

IT is stated in *Nature* that a committee has been formed in the Victoria University of Manchester to procure a portrait of Professor Osborne Reynolds, F.R.S., the senior member of the teaching staff, as a memorial of the

long and distinguished services which he has rendered to the Owens College and of his many valuable original contributions to physical science and engineering.

DR. H. S. JENNINGS, assistant professor of zoology in the University of Pennsylvania, has returned from the Zoological Station at Naples, Italy, where he has spent the past year conducting investigations on the behavior of the lower organisms as a research assistant of the Carnegie Institution.

MR. ROBERT T. HILL, late of the U. S. Geological Survey, has just returned from an extensive exploration trip in Mexico, which country he has been studying for many years, in order to ascertain its geologic evolution and history and relations to the geographic features of the United States and Central American region. Mr. Hill's address will continue to be 1738 Q Street, Washington, D. C.

MR. FREDERICK V. COVILLE, botanist of the United States Department of Agriculture, and Mr. Albert F. Potter, grazing expert of the Bureau of Forestry, have gone to the southwest grazing districts with a view to studying the ranges.

THE Mackinnon studentships of the Royal Society have been filled by the election of Mr. Bryan Cookson for research in astronomy, especially for a new determination of the constant of aberration, and Mr. L. Doncaster for work on the subject of variation and natural selection in plants and animals.

A BANQUET was given to Mr. Chamberlin, the well-known British political leader, on June 30, by the Royal Institute of Public Health, in recognition of his services to preventive and tropical medicine.

AT the second annual meeting of the British Academy, on June 29, Lord Reay was reelected president.

JEROME SONDERICKER, associate professor of applied mathematics at the Massachusetts Institute of Technology, died on July 22 at Wilmington, Vt.

DR. ISAAC ROBERTS, eminent for his work in astronomy, especially for his study of star clusters and nebulæ, has died at the age of seventy-five years.

THE death is also announced of Dr. L. Niemilowicz, professor of physiological chemistry at the University of Lemberg.

THE treasurers of the Institute of Medical Sciences Fund, London, have received the following additional donations: Lord Howard de Walden, £3,000; the Company of Fishmongers, 1,000 guineas; Dr. C. Theodore Williams £100.

THE British Medical Association is holding its seventy-second annual meeting at Oxford this week. Dr. G. D. Griffiths is the retiring president and Dr. W. Collier, the president-elect. The address in medicine is by Sir William S. Church and the address in surgery by Sir William Macewen.

THE Optical Society of London, of which Dr. R. T. Glazebrook is president, proposes holding an optical convention in London next year.

Nature states that a large deputation has waited on Lord Londonderry, president of the Board of Education, to urge the compulsory teaching of hygiene in elementary and secondary schools. The deputation was in support of a petition which has been signed by nearly fifteen thousand medical practitioners. The petitioners urged the central educational authorities of the United Kingdom to consider 'whether it would not be possible to include in the curricula of the public elementary schools, and to encourage in the secondary schools, such teaching as may, without developing any tendency to dwell on what is unwholesome, lead all the children to appreciate at their true value healthful bodily conditions as regards cleanliness, pure air, food, drink, etc.' The petitioners remark that a widespread ignorance prevails concerning not only the nature and properties of alcohol, but also its effects on the body and the mind. Central education authorities are therefore asked to include in the simple hygienic teaching desired elementary instruction at an early age on the nature and effects of alcohol. Dr. Farquharson, M.P., introduced the deputation, and short speeches in support of its objects were made by Sir W. Broadbent, Dr. D. Griffiths, Sir T.

Barlow, Sir Lauder Brunton, Sir Victor Horsley, Dr. Mary Scharlieb, Dr. Hutchinson and Professor Sims Woodhead. Lord Londonderry, in reply, said the proposals made by the deputation had his sincerest sympathy, and he only wished it was in the power of the board of education to carry them out. He was as anxious as any one to see increased instruction being given in the laws of health, but at the present time the necessary teachers did not exist, and he should be the last to wish anybody to act as instructor in such important subjects who had not received instruction in them. The board was at the present moment devoting itself to the training of teachers and instructing them properly in the whole question of hygiene. He trusted that as time went on its efforts in that direction would bring about the desired results.

The appropriation of $1,500 recently made by the New York State legislature for cooperative hydrographic work with the U. S. Geological Survey will be used in maintaining records of the rise and fall, the ordinary outflow, floods and droughts of many streams in the state. By means of these records it is possible to determine in specific cases the water supply available for canals, public water systems and water power. The condition of streams in more than fifty places in the state is regularly reported. The work has gradually grown until there is at present hardly a section of the state in which some river is not systematically measured. The list includes Chemung, Allegheny, Susquehanna, Chenango, Catskill, Delaware, Hudson, Mohawk, Saranac, Oswegatchie, Genesee, Oneida, Seneca, Oswego and Black rivers and their most important branches. The developed water power of these streams amounts to nearly 300,000 horse power, and they afford an almost unlimited amount of undeveloped power. Mr. Robert E. Horton, hydrographer, of Utica, N. Y., has charge of the work.

We learn from *Nature* that the Imperial Academy of Sciences of Vienna announces the following grants: To the Vienna Society for Solar Observation, 1,600 Krone for observations on climatic changes in the Goldberg glacier, and to Professor Ritter Beck von Managetta (Prague) 600 Krone for studies of plant distribution in the Julian Alps. From the Wedl bequest, to Drs. Obermayer and Pick (Vienna) 600 Krone for the chemistry of immune substances, to Dr. Moritz Probst 800 Krone for continuation of work on the brain, to Dr. Karl Camillo Schneider 400 Krone for a zoological expedition to Grado, to Professor Julius Tandler 1,000 Krone for studies in the development of birds. The committee of the Treitel legacy awards the following grants: To Professor Hans Skraup (Graz) 1,500 Krone for studies on albumens, to Dr. Franz Werner 6,000 Krone for a zoological expedition to the Egyptian Soudan, to Professor Julius Wiesner 4,000 Krone for effects of light on plant life in the Yellowstone district, to the Austrian Meteorological Society 4,000 Krone for investigations of the upper atmosphere, and to the Earthquake Commission 5,465 Krone 39 heller.

UNIVERSITY AND EDUCATIONAL NEWS.

Dr. Albert Fränkel, one of the leading German clinicians, who has been for twenty-seven years docent in the University of Berlin, has resigned. It is believed that his promotion to a professorship was withheld owing to the fact that he is a Jew. Dr. Hermann Oppenheim recently resigned under similar circumstances. He was unanimously recommended by the faculty for promotion, but the recommendation was not confirmed by the ministry.

Dr. Henry L. Woodward has been appointed assistant to the chair of physiology in the Medical College of Ohio, medical department of the University of Cincinnati.

At the University of Leeds, Dr. J. B. Cohen and Mr. Percy F. Kendall have been appointed professors of organic chemistry and of geology, respectively.

Dr. Döring has been appointed professor of analytical and applied chemistry at the University of Freiberg.

Dr. Karl Scheel has been made professor and member of the German Reichsanstalt.